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# Risk Factors for Sexually-Transmitted Diseases Among Deployed U.S. Military Personnel

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**Background and Objectives:** Information regarding risk factors for STD transmission is needed to assist in designing and evaluating prevention and control programs for US military populations.

**Goal of this study:** To obtain STD risk factor data among deployed U.S. military personnel.

**Study Design:** A questionnaire survey was administered to military personnel deployed aboard ship for six months to South America, West Africa, and the Mediterranean during 1989-1991.

**Results:** Among 1,744 male subjects (mean age, 23 years; 71% white; 96% enlisted), 49% reported prior sexual contact with a prostitute and 22% reported a history of a STD before deployment. During the subsequent six-month deployment, 42% reported sexual contact with a prostitute, 10% reported inconsistent use of condoms, and 10% acquired a new STD. By logistic regression analysis, sexual contact with a prostitute during deployment was independently associated with young age, nonwhite race/ethnicity, and being unmarried or divorced; inconsistent use of condoms was associated with Hispanic race/ethnicity.

**Conclusion:** These data indicate that deployed U.S. military personnel frequently engage in high-risk sexual behavior and that there is a continued need for comprehensive and culturally-sensitive STD prevention programs.

SEXUALLY TRANSMITTED DISEASES (STDs), which are the most frequently reported category of communicable diseases in the United States, have historically been a problem in military populations.<sup>1,2</sup> STDs are commonly acquired by military personnel outside of the United States, especially during overseas military deployments and during times of armed conflict.<sup>3-7</sup>

The prevention of STD transmission has become a more important priority of the military because of the human immunodeficiency virus (HIV) epidemic. In

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order to implement a STD prevention and control program that relies on education, risk factors for acquiring STDs in young, sexually-active populations must be understood.<sup>8,9</sup> However, the epidemiology of STDs in U.S. military populations has infrequently been characterized in recent years,<sup>10,11</sup> and under-reporting is common in the military's passive surveillance system.<sup>12</sup> In this study, risk factors for the transmission of STDs are evaluated in a questionnaire survey of U.S. military personnel deployed aboard ship to assist in evaluating and designing STD educational programs.

## Materials and Methods

Risk factor data were collected as part of a comprehensive investigation of STDs among deployed military personnel, and survey methods have previously been published in a study of viral hepatitis transmission.<sup>13</sup> In brief, the crew of six U.S. Navy ships scheduled for a six-month deployment to South America and West Africa and five ships scheduled for a six-month deployment to the Mediterranean were selected for the survey. Between 1989 and 1991, these ships made multiple port visits to cities along the East and West coasts of South America, West Africa, and in eight countries bordering the Mediterranean sea.

All Navy and Marine Corps personnel assigned to ships scheduled for the South American and West African deployment and all Marines assigned to the ships scheduled for the Mediterranean deployment were invited to participate in the study. Most eligible subjects available on the days when the survey was conducted provided informed consent and participated in the in-

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vestigation. The final study population included approximately 50% of the eligible crew members. The major reasons for nonparticipation were absence from the ship/base or other operational commitments during the time when the survey was conducted; consequently, there was no indication that the selection of the study population was related to risk factors for STD transmission.

Two standardized self-completed questionnaires were administered to small groups of subjects after full explanation of each question by the survey investigators. Personal identifiers were included in both questionnaires in order to match pre- and post-deployment questionnaire data with the results of serologic testing. However, risk factor data was kept confidential except for study purposes, as explained verbally to the study participants and in the consent form.

One questionnaire was administered pre-deployment and the other just prior to return to the U.S. mainland. The initial pre-deployment questionnaire elicited basic demographic information, including age, race/ethnicity, educational level, rank, and whether subjects were currently married, never married, or divorced. In the follow-up questionnaire, study subjects were asked about any history of contact with a prostitute and a STD prior to the current deployment. Also, subjects were asked about risk factors during the just-completed deployment, including sexual contact with prostitutes, whether condoms were used with 100% of sexual contacts or inconsistently with a lesser percentage of contacts, and the acquisition of a new STD.

No STD risk-related behavior questions were asked on the initial questionnaire in order to minimize the influence of the study on behavior during deployment. A history of a STD either before or during deployment was ascertained by asking subjects about a diagnosis of a STD or the occurrence of urethritis. In most cases, study subjects who had ready access to medical care had been diagnosed as having a STD by a corpsman or doctor.

Proportions were compared using the chi-square test with Yates' correction; mean values were compared by student's t-test. Unconditional multiple logistic regression analysis was performed with age and race/ethnicity included in all models using a forward selection process (SPSS/PC+: SPSS Inc., Chicago, IL). Two logistic models were developed for the following dichotomously coded outcome variables dealing with risk factors prior to the current deployment: any previous contact with a prostitute, and any history of a STD. Three logistic models were also developed for outcome variables dealing with risk factors during the just-completed six-month deployment: (1) contact with a prostitute; (2) inconsistent use of condoms; and (3) the occurrence of a new STD. For multivariate analysis, odds ratios (OR) are re-

ported with 95% confidence intervals (95% CI) calculated by using logistic regression parameter estimates and their standard errors.

## Results

### *Study Population*

There were 1,744 subjects evaluated both before and after a six-month shipboard deployment: 826 deployed to South American/West Africa and 918 deployed to the Mediterranean. There were 328 subjects initially evaluated prior to deployment who were lost to follow-up due to transfer or operational commitments during the post-deployment survey. The mean age of study subjects was 23 years (range: 18-50 years). The racial/ethnic composition of participants was 71% white, 19% black, 7% Hispanic, and 3% other. At the time the study was initiated, 36% of subjects were currently married, 61% never married, and 3% divorced.

Marines comprised 59% and Naval personnel 41% of the study population; 96% of subjects belonged to the enlisted ranks and 4% were officers. Study subjects had been on active military duty for a mean of 4.2 years, and 79% had previously been deployed outside the United States. Most participants (98%) had completed high school and 5% had completed college. Because educational level and rank were so closely related (1% of enlisted personnel had a college degree compared to 94% of officers), education was not separately evaluated in the following analysis.

### *Risk Factors Before Deployment*

Among 1,744 male subjects, a history of contact with a prostitute prior to the current deployment was reported by 49% (859). In bivariate analysis, currently divorced individuals most often reported contact with a prostitute and officers were least likely to report prostitute exposure (Table 1).

A history of a STD was reported by 387 (22%) subjects. Of these, 13 (0.7%) subjects reported a history of syphilis and 341 (20%) a history of gonorrhea/urethritis. A history of any previous STD was most common in older subjects, the black racial/ethnic group, and divorced subjects (Table 1).

By multiple logistic regression analysis, there was an independent association between prior prostitute contact and age, belonging to the enlisted ranks, being unmarried or divorced, and belonging to the Navy rather than the Marines (Table 2). In a separate logistic model, there was an independent association between a previous STD and age, black race/ethnicity, being divorced, and contact with a prostitute (Table 2).

**TABLE 1. Reported Life-Time History of Prostitute Contact and an STD Prior to Deployment by Demographic Characteristics Among 1,744 Military Personnel**

Characteristic	Percent Positive (No.)	
	History of Prostitute Contact	Any Prior STD
Age (years)		
17-19	40.8 (250)	11.9 (252)
20-24	49.6 (1,034)	21.5 (1,036)
25-29	47.5 (255)	27.7 (256)
≥30	61.8 (199)	31.5 (200)
Race/ethnicity		
White	49.6 (1,245)	18.2 (1,247)
Black	48.1 (322)	37.5 (325)
Hispanic	51.2 (125)	20.8 (125)
Other	51.1 (45)	26.7 (45)
Marital Status		
Married	43.6 (619)	24.0 (621)
Never married	51.8 (1,066)	19.8 (1,070)
Currently divorced	69.8 (53)	49.1 (53)
Rank		
Enlisted	50.4 (1,668)	22.3 (1,674)
Officer	25.7 (70)	18.6 (70)

### *Risk Factors During Deployment*

During the subsequent six-month deployment, 731 of the 1,744 study participants (42%) reported sexual contact with a prostitute. Of those having sexual contacts while ashore, 29% reported one partner, 35% two or three different partners, and 35%, four or more different partners. Sexual activity was most common in younger

**TABLE 2. By Multivariate Analysis with Age and Race/Ethnicity Included in All Models. Variables Independently Associated with any History of Prostitute Contact and a STD Prior to a Six-Month Deployment among 1,744 Military Personnel**

Dependent, Independent Variables*	OR	95% CI
Prior contact with a prostitute		
Age (by year)	1.07	1.04-1.1
Enlisted rank	4.1	2.3-7.4
Marital status (referent married)		
Never married	2.1	1.6-2.6
Divorced	3.6	1.9-6.7
Member of Navy (referent Marines)	2.5	2.0-3.0
Any history of a STD		
Age (by year)	1.04	1.02-1.07
Race/ethnicity (referent white)		
Black	3.1	2.4-4.2
Marital status (referent married)		
Divorced	2.9	1.6-5.4
Contact with a pros*	2.7	2.1-3.4

\* The table only lists variables and factors of variables that are independently associated with the outcome variable (95% CI for odds ratio does not include 1). Variables evaluated in logistic models included age, race/ethnicity, marital status, rank, military branch, and history of prostitute contact.

subjects, enlisted personnel, and currently unmarried subjects (Table 3).

Ninety-three percent of subjects reporting sexual contact with a prostitute stated that they used condoms; however, because condoms were not used with all sexual contacts, 10% of the entire study population (182 subjects) reported unprotected sexual contact during deployment. It is noteworthy that nine subjects reported that their condoms broke on at least one occasion during use. Condom utilization was reported least frequently by Hispanics and the "other" racial/ethnic category, enlisted personnel, and divorced subjects, and reported most frequently by the black race/ethnic group (Table 3).

Ten percent (166) of study participants reported acquiring a new STD during deployment. Acquisition of a STD was reported most often by divorced and enlisted personnel (Table 3). Although older individuals were more likely to have had a history of a STD, as previously noted, younger individuals were at highest risk for infection during the current deployment. There were nine subjects who reported being treated for a STD while off the ship by a foreign health care provider.

By multivariate analysis with age and race/ethnicity included in all models, sexual activity while ashore was independently associated with younger age, nonwhite race/ethnicity, being unmarried or divorced, deployment to South America/West Africa compared to the Mediterranean, and belonging to the Navy; inconsistent

**TABLE 3. Prostitute Contact, Inconsistent Use of Condom, and Acquisition of an STD During a Just-Completed Six-Month Deployment by Demographic Characteristics among 1,744 Subjects**

Characteristic	Percent Positive (No. responding to question)		
	Prostitute Contact	Inconsistent Use of Condoms	Acquired a New STD
Age (years)			
17-19	48.8 (252)	8.5 (246)	9.5 (252)
20-24	45.4 (1,031)	11.9 (1,019)	10.3 (1,036)
25-29	32.9 (255)	10.4 (250)	7.5 (255)
≥30	28.1 (199)	7.3 (191)	8.0 (199)
Race/ethnicity			
White	40.5 (1,243)	10.7 (1,223)	9.4 (1,246)
Black	47.5 (322)	6.1 (313)	9.9 (324)
Hispanic	40.0 (125)	18.7 (123)	9.6 (125)
Other	56.6 (45)	20.0 (45)	8.9 (45)
Marital Status			
Married	23.2 (620)	5.6 (608)	7.1 (620)
Never married	52.4 (1,065)	13.2 (1,048)	10.6 (1,069)
Currently divorced	55.8 (52)	20.0 (50)	17.0 (53)
Rank			
Enlisted	42.8 (1,667)	10.9 (1,637)	9.9 (1,672)
Officer	25.7 (70)	5.8 (69)	1.4 (70)

use of condoms was independently associated with Hispanic race/ethnicity, being unmarried or divorced, and belonging to the Navy; and, acquisition of any STD during deployment was independently associated with sexual activity, inconsistent use of condoms, and deployment to South America/West Africa (Table 4).

### Discussion

The military personnel participating in this study frequently reported a history of a STD and multiple sexual contacts with prostitutes, and 10% reported inconsistent use of condoms during a just-completed, overseas shipboard deployment. This high level of risk-related behavior demonstrates the critical need for continued educational efforts to prevent the transmission of STDs among military personnel.

TABLE 4. By Multivariate Analysis with Age and Race/Ethnicity Included in All Models, Variables Independently Associated with Prostitute Contact, Inconsistent Use of Condoms, and a New STD during a Just-Completed Six-Month Deployment among 1,744 Subjects

Dependent, Independent Variables*	OR	95% CI
<b>Sexual contact with prostitute while ashore</b>		
Age (by year)	0.95	0.92-0.97
Race/ethnicity (referent white)		
Black	1.4	1.1-1.8
Other	2.4	1.2-4.4
Marital Status (referent currently married)		
Never married	3.5	2.7-4.6
Current divorced	4.4	2.4-8.3
Deployment to South America/West Africa (referent, deployment to the Mediterranean)	6.7	4.5-9.8
Member of Navy (referent Marines)	1.6	1.1-2.3
<b>Inconsistent use of condoms with sexual contacts</b>		
Race/ethnicity (referent white)		
Black	0.5	0.3-0.9
Hispanic	1.9	1.2-3.3
Marital status (referent currently married)		
Never married	2.8	1.8-4.5
Current divorced	3.7	1.7-8.4
Deployment to South America/West Africa	6.2	3.9-9.8
Member of Navy (referent Marines)	2.3	1.5-3.5
<b>Acquisition of a new STD during deployment</b>		
Sexual contact with prostitute while ashore	2.4	1.6-3.7
Inconsistent use of condoms	2.3	1.5-3.5
Deployment to South America/West Africa	1.9	1.3-2.8

\* The table only lists variables and factors of variables that are independently associated with the outcome variable (95% CI for odds ratio does not include 1). Variables evaluated in logistic models included age, race/ethnicity, marital status, rank, military branch, deployment location, history of prior deployment, and prostitute contact and inconsistent use of condoms during deployment.

The findings of this survey also demonstrate the need to design educational programs that are culturally sensitive and that focus on high-risk groups. The youngest age groups and divorced and never married individuals were particularly likely to engage in high-risk sexual activity, and Hispanics were least likely to use condoms. These findings are consistent with prior studies of shipboard personnel and studies indicating that young, nonwhite, and unmarried military personnel are at greatest risk of acquiring HIV infection.<sup>14-16</sup>

When designing prevention programs, consideration also has to be given to the finding that troops deployed to certain regions, such as South America/West Africa, may be at higher risk of acquiring a STD and consequently require more intensive educational interventions.

Current education approaches in the military services promote both abstinence and the use of condoms, which are readily available aboard ship. In this study, the high level of reported condom use compared to previously surveyed shipboard populations and apparent protection against STDs suggest that educational efforts are very worthwhile.<sup>5,17,18</sup> However, the high rate of sexual activity reported by study subjects resulted in a substantial risk of contracting a STD, especially among those who did not consistently use condoms.

When interpreting these findings, several limitations of this questionnaire survey should be considered. For one, due to restriction of the study to male shipboard personnel, the results are not representative of females in the military or military populations permanently stationed in the United States.

Another limitation of this survey is the likelihood that promoted behavior, like condom use, was over-reported and high-risk behavior was under-reported. Military personnel, particularly officers, probably under-reported risk behavior because of concern that such behavior, if known, could hamper career advancement. In addition, married individuals would be less likely to admit sexual activity while deployed. Consequently, lower levels of high-risk behavior among officers and married study subjects may have been the result of under-reporting to some extent. Whether lower reported levels of high-risk behavior by Marines compared to Navy personnel was also due to under-reporting could not be determined. However, this finding is important because it is consistent with lower rates of HIV infection in this branch of the military.<sup>15</sup>

A third limitation of the study was the possibility of bias from selective sampling of just half of eligible study subjects. However, there was no reason to suspect that the causes for nonparticipation had a significant relation to STD risk-related behavior. Also, the age and racial/ethnic composition of the final study population was al-

most exactly as expected based on studies of Navy and Marine Corps recruit populations,<sup>19</sup> indicating that no group was preferentially sampled.

Despite these limitations, this type of active surveillance using a questionnaire survey provides valuable preliminary information indicating high levels of risk behavior for the transmission of STDs among deployed military personnel.

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